

# Geologic Resources Inventory Workshop Summary



## **Outer Banks Group Capes Hatteras and Lookouts National Seashores Wright Brothers National Memorial Fort Raleigh National Historic Site *April 3-5, 2000***

## **National Park Service *Geologic Resources Division* *and* *Natural Resources Information Division***

Version: Draft of July 11, 2000

### **EXECUTIVE SUMMARY**

An inventory workshop was held for the Outer Banks Group (Cape Hatteras NS, Cape Lookout NS, Wright Brothers NM, and Fort Raleigh NHS) on April 3-5, 2000 to view and discuss the park's geologic resources, to address the status of geologic mapping by various academics, the North Carolina Geological Survey (NCGS) and the United States Geological Survey (USGS) for compiling both paper and digital maps, and to assess resource management issues and needs. Cooperators from the NPS Geologic Resources Division (GRD), NPS Outer Banks Group, NCGS, USGS, and Eastern Carolina University (ECU) were present for the two-day workshop. ([See Appendix A, Outer Banks Group Geological Resources Inventory Workshop Participants, April 3-5, 2000](#))

## Outer Banks Group GRI Workshop Summary: April 3-5, 2000 (cont'd)

Day one involved a field trip throughout Cape Hatteras NS led by ECU geology professor Stan Riggs.

Day two involved a half-day field trip to Wright Brothers NM and Fort Raleigh NHS, followed by a half-day scoping session to present overviews of the NPS Inventory and Monitoring (I&M) program, the Geologic Resources Division, and the ongoing Geologic Resources Inventory (GRI) for North Carolina.

Day three involved a field trip throughout Cape Lookout NS led by Michael Rikard and attended by Tim Connors and Bruce Heise.

On day two, round table discussions involving geologic issues for the Outer Banks included interpretation, paleontologic resources, the status of cooperative geologic mapping efforts, sources of available data, geologic hazards, and action items generated from this meeting. Brief summaries follow.

Specific presenters during the scoping session included the following:

- Steve Harrison (NPS-CAHA) gave a presentation on Cape Hatteras entitled "A Brief History Of Dune Construction, Dune Stabilization, Beach Nourishment At Cape Hatteras National Seashore" (for a recap of this presentation, see <http://www2.nature.nps.gov/grd/geology/gri/products/ppt/caha/>)
- Tim Connors and Bruce Heise (both NPS-GRD, Denver, Colorado) spoke on the Geologic Resources Inventory (GRI)
- Rob Thieler (USGS-Woods Hole, Massachusetts) spoke about USGS efforts for "Mapping and Coastal erosion processes along the North Carolina coast".

### OVERVIEW OF GEOLOGIC RESOURCES INVENTORY

After introductions by the participants and Steve Harrison's talk, Tim Connors and Bruce Heise presented overviews of the Geologic Resources Division, the NPS I&M Program, the status of the natural resource inventories, and the GRI in particular (*see Appendix B, Overview of Geologic Resources Inventory*).

They also presented a demonstration of some of the main features of the **digital geologic map** for the Black Canyon of the Gunnison NP and Curecanti NRA in Colorado. This has become the prototype for the NPS digital geologic map model as it ideally reproduces all aspects of a paper map (i.e. it incorporates the map notes, cross sections, legend etc.) with the added benefit of being a GIS component. It is displayed in ESRI ArcView shape files and features a built-in help file system to identify the map units. It can also display scanned JPG or GIF images of the geologic cross sections supplied with the map. The cross section lines (ex. A-A') are subsequently digitized as a shape file and are hyperlinks to the scanned images.

## Outer Banks Group GRI Workshop Summary: April 3-5, 2000 (cont'd)

Also demonstrated was the developing NPS data browser for adding various coverage's into GIS projects "on-the-fly". With this functional data browser, numerous NPS themes can be added to an ArcView project with relative ease. Such themes might include geology, paleontology, hypsography (topographic contours), vegetation, soils, etc.

The NPS GRI (Geologic Resources Inventory) has the following goals:

1. to assemble a bibliography of associated geological resources for NPS units with significant natural resources; "GRBIB",
2. to compile and evaluate a list of existing geologic maps for each unit,
3. to develop digital geologic map products, and
4. to complete a geological report that synthesizes much of the existing geologic knowledge about each park.

It is stressed that the emphasis of the inventory is **not** to routinely initiate new geologic mapping projects, but to aggregate existing information and identify where serious geologic data needs and issues exist in the National Park System. In cases where map coverage is nearly complete (ex. 4 of 5 quadrangles for Park "X") or maps simply do not exist, then funding may be available for geologic mapping.

### **GRBIB**

During the scoping session, each park is presented with a compiled, park specific geologic bibliography as compiled by GRI staff. The sources for this compiled information are as follows:

- AGI (American Geological Institute) GeoRef
- USGS GeoIndex
- ProCite information taken from specific park libraries

These bibliographic compilations are then validated by NPS staff to eliminate duplicate citations and typographical errors, and check for applicability to the specific park. After validation, they become part of a Microsoft Access database parsed into columns based on park, author, year of publication, title, publisher, publication number, and a miscellaneous column for notes.

From the Access database, they are exported as Microsoft Word Documents for easier readability, and eventually turned into PDF documents. They are then posted to the GRI website at: <http://www2.nature.nps.gov/grd/geology/gri/products/geobib/> for general viewing.

Upon review of the compiled bibliography for the Outer Banks, it was noted that many publications by Stan Riggs were missing from our outputs. It was suggested to do a keyword search on "Riggs" and to also consult the Bibliography of Coastal Geology,

## Outer Banks Group GRI Workshop Summary: *April 3-5, 2000 (cont'd)*

then recompile the bibliography. GRI staff are working on this and will let the group know when this has been accomplished.

### **EXISTING GEOLOGIC MAPS**

After the bibliographies were assembled, a separate search was made for any existing surficial and bedrock geologic maps for the specific parks. The bounding coordinates for each map were noted and entered into a GIS to assemble an index geologic map. Separate coverage's were developed based on scales (1:24,000, 1:100,000, etc.) available for the specific park.

Of note for the Outer Banks region is that there are no existing published 1:24,000 scale geologic quadrangles. The only existing published map appears to be a 1:250,000 scale map included in "*Reconnaissance geology of the submerged and emerged Coastal Plain province, Cape Lookout area, North Carolina*" by Mixon and Pilkey, USGS Professional Paper 859, 1976.

A general consensus of the cooperators present was that the existing USGS PP 859 was a good general publication for its time, but the map scale (1:250,000) was not sufficient for park management resource needs at the present time (1:24,000 is desired), and that much more detailed mapping was needed.

### **PLAN FOR ACCOMPLISHING GEOLOGIC COVERAGE**

#### ***Existing Cooperative Endeavors***

At the present time, the USGS, NCGS and ECU are involved in a Coastal Cooperative project. This involves geologic mapping of the barrier islands of the Outer Banks of North Carolina. Their intended products include a geologic map and a better understanding of the subsurface of the Outer Banks.

*According to Rob Thieler, their FY-2000 goals are the following:*

1. sea-floor mapping for the inner shelf component from as landward as they can get to approximately five nautical miles offshore (main contact: Rob Thieler);
2. shoreline surveys with SWASH buggy to look at storm event response along shoreline watching accretion patterns along beach (main contact: Jeff List)
3. airborne topographic mapping using LIDAR for beach and dune changes during storms (main contact: Abby Sallenger);
4. cooperative research programs with NCGS-ECU-USGS

Their funding is as follows:

- FY-2000 \$480,000-500,000;
- FY-2001 \$750,000; \$150,000 of which will be targeted for the cooperative with NCGS and ECU; other \$600,000 will go towards shoreline mapping and SWASH projects
- FY-2002 may reach \$1.75 Million.

It was suggested that Bruce Heise (NPS-GRD) and Jeff Williams (USGS) collaborate to locate other potential NPS-USGS sources to assist in funding this cooperative.

## Outer Banks Group GRI Workshop Summary: April 3-5, 2000 (cont'd)

LIDAR, laser altimetry and SWASH technologies are being used to create "before and after" maps to define pre-, during-, and post-storm shoreline change (like in the Rodanthe area). Some of this data should be available on the USGS Coastal website (<http://marine.usgs.gov/>).

The NPS-GRI seems timely for teaming up with these other agencies to facilitate the production of an adequate geologic database for the Outer Banks area. It was suggested that the represented agencies continue to work cooperatively to achieve a better understanding of the geologic processes occurring both on- and off-shore of the Outer Banks.

*It was thought that under the existing USGS-NCGS-ECU cooperative the following items could be produced into a geologic database:*

- **Offshore bathymetric / onshore topographic map** (Rob Thieler considers existing data as only reconnaissance level and probably needs refinement);
- **"Time-slice" / paleogeographic maps;**
- **Isopach and structural contour maps showing unit age breakdowns;**
- **Shoreface / shelf maps** (i.e. submarine version of surface maps);
- **Sediment texture maps** (from side-scan)
- **Geologic cross sections** showing both above ground- and bathymetric profiles

The NCGS thought they could produce as part of their separate program a **Geologic environments / geomorphic map**. They would likely work with habitat specialists on this and it would likely take at least three years to produce.

*Some other desirable items to produce, but currently not in progress, planned or funded are the following:*

- **Ecosystem / habitat map** produced by working with habitat specialists;
- **Shoreline erosion and erosion rates map;**
- **historic and modern shorelines map**
- **Distribution of Geologic processes and hazard maps** (i.e. to show potential inlets, historic inlets, overwash, erosional hot spots);
- **Anthropogenic effects map** (man's effect on features like drainage ditches, dikes for mosquito control)
- **Changing composition of beach sediments** (spatially) to show heavy mineral distributions
- **Distribution of Hard bottoms**
- **distribution of paleontological features / fossils**

### **GEOLOGIC REPORT**

It is the desire of the GRI to produce an encompassing geologic report for each park containing the following elements:

- History of Geologic Exploration

## Outer Banks Group GRI Workshop Summary: April 3-5, 2000 (cont'd)

- Geologic Setting
- Geologic History
- Structure
- Unique Geologic Features
- Paleontology
- Disturbed Lands
- Geologic Hazards and Issues
- Geologic Data
- References
- Future Research topics
- Other topics and sections as needed

At this point in time, no such report exists. Again, USGS Professional Paper 859 is useful but does not cover all of the above topics adequately for NPS needs. Stan Riggs was suggested as the right person to develop such a report for the Outer Banks parks. There are funding considerations as a factor in obtaining his time and resources.

Riggs felt that the general public would respond more favorably to Outer Banks issues with good, solid science to back it up. This would include showing how the islands have changed with time, the processes by which they're changing, and where they are going. Then perhaps the public will realize not to interfere with natural processes once educated on them.

### Other Issues

#### ***Interpretation***

One goal of GRD is to promote geologic resource interpretation within the National Park Service. GRD has staff and technology to assist in preparation of useful materials including developing site specific bulletins, websites, and resource management proposal (RMP) statements appropriate to promoting geology. Jim Wood (GRD) and Melanie Moreno (USGS-Menlo Park, CA) have worked with several other NPS units in developing web-based geology interpretation themes, and should be considered as a source of assistance should the park desire. GRD has also received much positive recognition for the "Park Geology Tour of National Parks" and subsequent "Geology Field Notes" at <http://www2.nature.nps.gov/grd/tour/index.htm>. GRD posted these sites based on available park brochures, but they are always in need of fresh material. Park staff may wish to review these and suggest improvements to GRD.

#### ***Status of Soils Mapping***

*Note: Awaiting Pete Biggam (NPS-Soil Scientist) suggestions as of 2000-07-10*

#### ***Paleontology***

GRD provides support on policy and GPRA (government performance and results act) goals related to paleontological resources in parks. At the present time, Paleontology is **not** one of the main baseline natural resource inventories, but it has been included within the GRI.

## **Outer Banks Group GRI Workshop Summary: April 3-5, 2000 (cont'd)**

NPS Paleontologists are in favor of a mandate for protecting paleontological resources within federal lands. GRD staff have led refresher-training courses for NPS rangers at multiple parks to raise awareness for the protection of paleontological resources. Often a first step is for parks to determine whether they have paleontological resources, and then to have a baseline inventory completed.

Many parks have become interested in having Paleontological Surveys conducted. Surveys are already completed or in progress for Zion, Yellowstone and Death Valley. Vince Santucci ([Vince\\_Santucci@nps.gov](mailto:Vince_Santucci@nps.gov); NPS-GRD Paleontologist) is always willing to discuss such matters with park staff, if they are interested.

Often, these surveys have shed valuable new information on previously unrecognized resources. These surveys involve a literature review/bibliography and recognition of type specimens, species lists, and maps (which are unpublished to protect locality information), and also make park specific recommendations for protecting and preserving the resources.

HTML Samples of existing paleontological surveys are available online at:  
[http://www.nature.nps.gov/grd/geology/paleo/yell\\_survey/index.htm](http://www.nature.nps.gov/grd/geology/paleo/yell_survey/index.htm)

and as a PDF at <http://www.nature.nps.gov/grd/geology/paleo/yell.pdf>

If a paleontological survey were conducted and yielded significant findings, the following might be derivative steps:

- Develop resource management plans including inventory and monitoring to identify human and natural threats to these resources;
- Incorporated findings or suggestions into park general management plans (GMP);
- train park staff (including interpreters and law enforcement) in resource protection, as the fossil trade "black market" has become quite lucrative for sellers and often results in illegal collecting from federal lands;
- Collections taken from the area residing in outside repositories could be tracked down for inventory purposes;
- Fossils offer many interpretive themes and combine a geology/biology link and should be utilized as much as possible in interpretive programs.

Vince Santucci knew of a walrus skull find along the shores of Cape Hatteras, however park staff were not sure of the exact collection and repository location.

One question related to the definition of a "fossil" could pose management issues for the Outer Banks. Steve Harrison mentioned that they consider all shells found on the beach as 'fossils'; however NPS policy states that fossils cannot be collected from NPS lands. The park may want to reconsider their definition of "fossil" to reflect this. Santucci could be consulted for input on this topic.

## **OTHER SOURCES OF NATURAL RESOURCES DATA**



## Outer Banks Group GRI Workshop Summary: April 3-5, 2000 (cont'd)

- According to attendees, a new Manteo 1:250,000 sheet has been produced by the USGS;
- estuarine data exists on CD-ROM according to Bill Hoffman NCGS); unpublished as of yet
- Bill Hoffman gave GRD four reports on sand resource assessments
- Nicky Ernst says the NPS Inventory and Monitoring Program has supplied the Outer Banks group with digital elevation models (DEMs).
- CAHA has aerial photos dating back to 1930s; Nicky could georeference them and digitize them; Stan Riggs says data are not georeference and no good metadata to support it (i.e. no weather data when flown, water levels). Bob Dolan has done a lot with this and same problem is no control on the data
- USGS Coastal Website: <http://marine.usgs.gov/>
- Corps of Engineers may have 40 years of data for CALO shoreline (mapped in 1960 and 1976; should update again to get 40 years of coverage)
- Kathleen Farrell has produced a draft open file report entitled "Geomorphology of the Lower Cape Fear River, North Carolina". It is an ArcInfo coverage at 1:50,000 scale and reflects interpretive geomorphology. It is compiled from seven quadrangles and numerous data sets including topographic-, soils- and national and state wetlands inventory maps, as well as aerial infrareds. Kathleen thinks it is also useful for hazard assessments

### ACTION ITEMS

Many follow-up items were discussed during the course of the scoping session and are reiterated for quick reference.

**General:** Check on cooperating with Carolina Geological Society

**Interpretation:** If desired consult with GRD's Jim Wood ([jim\\_f.wood@nps.gov](mailto:jim_f.wood@nps.gov)) or Melanie Moreno at the USGS-Menlo Park, CA ([mmoreno@usgs.gov](mailto:mmoreno@usgs.gov)) for additional assistance with various interpretation themes

**Natural Resources:** consult with Santucci on NPS official definition of fossil and Paleontological Resources

**Geologic Mapping:** work with existing cooperative to accomplish production of digital database for Outer Banks

**Natural Resource Data Sources:** track down listed sources/references; repair/refine GRBIB for Outer Banks as suggested by Stan Riggs.



**APPENDIX A**  
**Outer Banks Group Geological Resources Inventory Workshop Participants**  
*April 3-5, 2000*

NAME	AFFILIATION	PHONE	E-MAIL	Field Trip	Scope
Bruce Heise	NPS, Geologic Resources Division	(303) 969-2017	<a href="mailto:Bruce_Heise@nps.gov">Bruce_Heise@nps.gov</a>	X	X
Tim Connors	NPS, Geologic Resources Division	(303) 969-2093	<a href="mailto:Tim_Connors@nps.gov">Tim_Connors@nps.gov</a>	X	X
Steve Harrison	NPS, CAHA	(252) 473-2111 ext.159	<a href="mailto:Steve_Harrison@nps.gov">Steve_Harrison@nps.gov</a>	X	X
Michael Rikard	NPS, CALO	(252) 728-2250 ext.3012	<a href="mailto:Michael_Rikard@nps.gov">Michael_Rikard@nps.gov</a>		X
Stan Riggs	Eastern Carolina University	(252) 328-6379	<a href="mailto:Riggss@ecu.edu">Riggss@ecu.edu</a>	X	X
Bill Hoffman	NC Geological Survey	(919) 733-7353 ext.25	<a href="mailto:Bill.Hoffman@ncmail.net">Bill.Hoffman@ncmail.net</a>	X	X
Kathleen Farrell	NC Geological Survey		Kathleen.Farrell@ncmail.net	X	X
Rob Theiler	USGS	(508) 457-2350	<a href="mailto:Rthieler@usgs.gov">Rthieler@usgs.gov</a>	X	X
Steve Culver	ECU	252-328-6360	culvers@mail.ecu.edu	X	X
Nikki Ernst	NPS, CAHA Cartographic Technician		Nikki_Ernst@nps.gov	X	X
Keith Watson	NPS, CAHA	(252) 473-2111 ext. 132	<a href="mailto:Keith_watson@nps.gov">Keith_watson@nps.gov</a>	X	X

## **APPENDIX D**

### **NCGS Index of Quadrangle Maps**

The NPS Geologic Inventory is a collaborative effort of the NPS Geologic Resources Division (GRD) and Inventory and Monitoring Program (I&M) with assistance from the U.S. Geological Survey (USGS), American Association of State Geologists (AASG), and numerous individual volunteers and cooperators at NPS units, colleges, and universities.

From the perspective of the servicewide I&M Program, the primary focus (Level 1) of the geological inventory is

1. to assemble a bibliography of associated geological resources for NPS units with significant natural resources,
2. to compile and evaluate a list of existing geologic maps for each unit,
3. to develop digital geologic map products, and
4. to complete a geological report that synthesizes much of the existing geologic knowledge about each park. The emphasis of the inventory is not to routinely initiate new geologic mapping projects, but to aggregate existing information and identify where serious geologic data needs and issues exist in the National Park System.

The NPS Geologic Resources Division is an active participant in the I&M Program and has provided guidance and funding in the development of inventory goals and activities. GRD administers the Abandoned Mine Lands (AML) and Geologists In Parks (GIP) programs which contribute to the inventory. NPS paleontologists, geologists, and other natural resource professionals also contribute to inventory planning and data. A major goal of the collaborative effort is to provide a broad baseline of geologic data and scientific support to assist park managers with earth resource issues that may arise.

For each NPS unit, a cooperative group of geologists and NPS personnel (the Park Team) will be assembled to advise and assist with the inventory. Park Teams will meet at the each NPS unit to discuss and scope the geologic resources and inventory, which is the subject of this report. If needed, a second meeting will be held at a central office to evaluate available geologic maps for digital production. After the two meetings, digital geologic map products and a geologic report will be produced. The report will summarize the geologic inventory activities and basic geology topics for each park unit. Due to the variety of geologic settings throughout the NPS, each report will vary in subject matter covered, and section topics will be adapted as needed to describe the geologic resources of each unit. Whenever possible the scientific sections of the report will be written by knowledgeable cooperators and peer reviewed for accuracy and validity.